

number of finite segments at infinity; to enumerate them we require transcendent integers, but there is nothing illogical in the conception, provided that we use it consistently. But we must not criticise one conception by the results of another with which it is radically incompatible.

To show how weak the author's logic is, it is sufficient to refer to his discussion of the old fallacy of Achilles and the tortoise. Here it is established that an indefinite number of successive intervals of time can be found, for each of which the tortoise is ahead; and it is falsely concluded that the sum of these intervals of time tends to an indefinitely long period. Instead of pointing out this simple fact, Dr. Geissler argues that the division of the initial interval between Achilles and the tortoise is illegitimate! ("Man darf sich nicht einbilden, es liege schon im Wesen einer Strecke AB auf ihr in irgend einer Weise Strecken zu tragen.") In fact, his hankering for infinitesimals, in the sense of indivisibles, makes all his treatment of limits and convergence quite unsatisfactory.

It is a matter for real regret that Dr. Geissler has so completely failed to contribute anything of value to the discussion of his subject. The development of mathematics since the time of Kant has surely provided some new material for speculation; how long must we wait for a philosopher competent to deal with it? Even De Morgan failed to appreciate Rowan Hamilton's conception of algebra as the science of pure time; the truth of this idea (except, perhaps, for group-theory) is becoming daily more evident. But while analysis is thus practically reduced to a subjective construction, there are elements in geometry which refuse to be so assimilated. Not all mathematicians are geometers, but those who are will sturdily maintain that, in some sense or other, there are geometrical data which are not expressible in terms of arithmetic. The present tendency towards critical analysis may, we hope, be succeeded by renewed interest in pure geometry. Then, perhaps, something more may be done towards distinguishing its primary axioms.

The analytical doctrine of the infinite has been sketched in a very interesting manner by Dr. Hobson in his recent presidential address to the London Mathematical Society; this deserves to be widely read, because it presents the main discoveries of Dedekind, Cantor, &c., in a form which does not assume any advanced mathematical knowledge on the part of the reader.

G. B. M.

PRACTICAL PHYSIOLOGY.

Practical Physiology. By A. P. Beddard, J. S. Edkins, Leonard Hill, J. J. R. Macleod and M. S. Pembrey. Pp. xiv + 495 (London: Edward Arnold, 1902.) Price 15s. net.

THE aim of the authors of this text-book has been to provide medical students with a course of physiology which shall not only give them sufficient mental training—practical Chinese or Greek would do this—but also ensure that this training shall be of substantial use

in their after medical career. In some respects, this aim has been carried out in an admirable manner. Many of the articles are clearly written and well illustrated, and some of the sections—notably those on circulation, blood gases and physiological optics—contain valuable information not readily accessible to the student in any of the existing text-books. Other parts hardly maintain this high level, and the chapters on muscle and nerve in particular are noticeably deficient, even allowing for the author's expressions of dissent in the preface, and it is curious to see a text-book of 495 pages in which only two are devoted to the description of the galvanometer and capillary electrometer together, and where three lines contain the major part of the information on the electromotive phenomena of the heart!

The book is divided into four parts; the first two of these, comprising the more elementary exercises, are, on the whole, very good. The labour involved in preparing new illustrations and tracings must have been considerable, and the authors are justly to be congratulated on the result of their exertions. In addition to the experimental exercises already noticed, the section on physiological chemistry merits favourable comment, and as a pleasing matter of detail, the drawings of crystals are particularly accurate.

There are certain places, however, which might be subjected to a little revision in the next edition. While the authors reject Von Fleisch's hæmoglobinometer on the ground of inaccuracy, the directions given for the use of the Thoma-Zeiss hæmocytometer will in practice lead all but the very careful student to far more serious errors of estimation. With a little skill, the method for the detection of albuminuria by heat could be carried out so as to show no trace of albumin even when it was present in considerable amount, as acid albuminate would readily be formed under the conditions recommended. "Ethylic acid," on p. 180, is a pretty obvious misprint for "ethyl alcohol." We think that the information on p. 72 is a little out of place, but perhaps this is a matter of opinion.

The "advanced" portion of the text-book is hardly so well written as the "elementary," though the articles on optics and on Haldane's methods for determining oxygen capacity and mass of the blood could hardly be surpassed. Here, moreover, is to be found the largest part of the "comedy of errors" which is inseparable from a first edition. Constantine was an Emperor who reigned at Constantinople; the alloy of manganese and iron used for thermoelectric work was not called after him. The directions for preparing sarcosylactic acid, on pp. 442-3, would be improved by the substitution of the word "phosphoric" for "sulphuric," and the method, on p. 426, for decomposing proteids contains more than one serious error, and should be re-written throughout.

But besides these smaller matters, there is an authoritative method adopted of disposing summarily of controversial points by *ex cathedra* utterances; we think that a text-book writer might, in a fairly complete work such as this, at least mention the possibility of different views being held by other physiologists, absurd though this may seem to him.

It is a pity that an index was not included in the book;

the few pages that are dignified by the name are merely a mockery to anyone who is not one of the authors.

However, even with these easily remedied defects, the book is a good and useful one which can be recommended to the student as one to be added to his library.

OUR BOOK SHELF.

Studies in the Cartesian Philosophy. By Norman Smith, M.A. Pp. xiv + 276. (London: Macmillan and Co., Ltd.; New York: The Macmillan Company, 1902.) Price 5s. net.

THE title of Mr. Smith's book conveys an adequate idea of its scope. The author indicates the lines of his treatment thus:—"In Descartes' system, as we have tried to show, there are three fundamental tenets, viz. the doctrine of representative perception, a very peculiar form of rationalism, and the conception of spirit as an active creative agency" (p. 115). The main portion of the book (pp. 1-115) is devoted to Descartes, with appendices on "Arnauld's denial of the doctrine of representative perception" and on Descartes' views of perception, time and consciousness (pp. 115-136). The rest of the book deals with Cartesian principles in Spinoza, Leibniz and Locke, with Hume's criticism and "the transition to Kant."

The author's treatment is lucid throughout; the main lines of criticism are stated clearly, and, on the whole, adequately. This is especially true of the chapters on Descartes and Locke, where the author has allowed himself to treat the subject at greater length. As to Descartes, the author says, "his philosophy of nature I have reserved for further consideration, and in this present volume limit myself, as far as possible, to his metaphysics" (preface, p. vi). His reason for thus dividing the subject is that Descartes' "metaphysical teaching is perverted by principles wholly at variance with his own positive scientific views" (preface, p. i.). This point is specially brought out in contrasting Descartes' physical and metaphysical views of motion (pp. 70-71).

With regard to the salient features of Descartes' teaching, Mr. Smith considers that the *cogito ergo sum*, so far from being "the really ultimate element in his system," is "simply one consequence of the doctrine of representative perception which is itself a consequence of his dualistic starting point" (p. 14). The importance of "method" as "not merely an instrument for constructing knowledge" (p. 23) and the relation of method to Descartes' view of intelligence is well brought out; the same may be said of the author's treatment of the deductive mathematical method and its fallacies. In "the proof of the existence of God," Mr. Smith thinks "Descartes' scholasticism came to a height." He rightly treats some of the Cartesian arguments as purely "official" (p. 64). But we cannot say that he is altogether clear upon the relation of the system as a whole to God; it may be disputed whether Descartes ever meant by God "the all-comprehensive absolute reality." Certainly we can recognise the universality of the criterion without identifying the system with its maker. The author's argument is scattered and somewhat divided between what Descartes really meant and what he really said.

The discussion on Locke is an excellent chapter; the treatment of "substance" and "the unknown" may be specially mentioned (v. p. 195). The treatment of Spinoza and Leibniz, though suggestive, is too brief. As the value of this book lies not so much in its originality as in the accurate exposition of certain lines of thought which have dominated modern philosophy, the author should not have allowed the recent works on these philosophers to cramp his own treatment. The section on Berkeley

suggests the same criticism. Yet the many good qualities of the book should recommend it to all students of philosophy. It is adequately furnished with references and has a good index. G. S. B.

Die progressive Reduktion der Variabilität und ihre Beziehungen zum Aussterben und zur Entstehung der Arten. By Daniel Rosa, Professor of Zoology in the University of Modena. Authorised Translation from the Italian by Dr. H. Bosshard. Pp. 106. (Jena: Gustav Fischer, 1903, published 1902.) Price 2.50 marks.

PROF. D. ROSA begins his interesting essay by saying that cuttlefishes might envy the obscurity which multitudinous evolutionist-pamphlets—likened to "ink-squirts"—have given to the troubled waters surrounding the rock of the theory of descent; but this somewhat cynical outlook has happily not hindered him from publishing (in 1899) the booklet before us or from having it translated into German by Dr. H. Bosshard. We have both versions of the essay, and, so far as we can judge, the translation is exceedingly well done.

In his first chapter, Rosa pictures organic evolution as a long-drawn-out "substitution process," in the course of which many groups, having reached their acme, give place to others springing from a lower level of the phylogenetic stem and retaining a capacity for abundant and far-reaching variation. As a group becomes more perfect, it tends to nirvana; its variations are reduced in number, or, in any case, in range; and the extinction of "lost races" like Graptolites, Trilobites, Ammonoids, Pterodactyls, &c., is causally associated with a progressive reduction of variation. It has to be admitted, however, that we do not really know much about the scope of variation in the last days of lost races.

In the second chapter, Rosa inquires whether the progressive reduction of specific variations is wholly due to natural selection or in part also to internal organismal conditions. He emphasises two points:—(1) that an organ which disappears in the course of evolution never reappears along that line of descent, that an organ which has become retrogressive never reacquires the capacity of progress; and (2) that in many cases, there is a constancy or fixity in the numerical relations of parts, e.g. segments, limbs and digits, from which the type seems quite unable to free itself. These two sets of facts point to a progressive reduction of variability, especially in types towards the ends of the phyletic branches. This theory is corroborated by detailed reference to the limitations which structural and functional differentiation seems to impose upon the variability of tissues and cells. Evolution is dominated by the "law of progressively reduced variability."

The third chapter is less of a unity, for the author has been impelled to speak briefly "de omni re scibili et de quibusdam aliis." Rosa attaches little importance to individual fluctuations; he relies upon general changes or mutations of the idioplasm occurring throughout the species. He has done useful service in indicating the tendency to reduction of variability in highly evolved types; his essay is very interesting and suggestive, pleasantly free from dogmatism or verbal polemics; but we must wait for more detailed data, and admit that "Thatsachen, nicht Ansichten, entscheiden."

J. A. T.

Steel Ships: their Construction and Maintenance. A Manual for Shipbuilders, Ship Superintendents, Students and Marine Engineers. By Thomas Watson. Pp. xiv + 290. (London: Charles Griffin and Co., Ltd., 1901.) Price 18s. net.

THE title of this work led us to hope that a long-felt want had at length been supplied; but we regret to have to say that on reading it we were disappointed. Mr. Watson does not appear to have the scientific